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Applicant: Mitsubishi Heavy Industries Co., Ltd.

2-5-1, Marunouchi, Chiyoda-Ku, Tokyo

Inventor: Etsuo Nagaoka

1-1-1, Wadasaki-Cho, Hyogo-Ku, Kobe, Hyogo Prefecture

Patent Attorneys: Toshiro Mitsuishi, et al.

[Title of the Invention]

TRAVELLING DEVICE

[Abstract]

[Object]

To realize easy inspecting operations on the irregular ground by preventing a travelling device to fall down and simplifying the mechanism and control system of the device.

[Configuration]

In a travelling device, an expandable gas cylinder 16 is provided on a running carriage 11 having a pair of left and right driving wheels 12, 13 located in parallel to each other and adapted to be driven independently in such a manner as to erect therefrom, and a gyroscopic lift standing-up mechanism having an inclination steering mechanism is provided on the top portion of the gas cylinder 16. In a case where the travelling device needs to ride on while travelling, a device main body is moved to the vicinity of the obstacle and caused to incline forward by means of flaps 45, and the gas cylinder 16 is caused to be contracted rapidly so as to lift up the running carriage 11, whereby the travelling device is moved in the air by virtue of a lift so produced to thereby allow it to ride on the obstacle.

[Claim]

[Claim 1]

A travelling device characterized in that an expandable gas

cylinder is provided on a running carriage having a pair of driving wheels disposed in parallel to each other and designed to be driven independently in such a manner as to erect therefrom and that a gyroscopic lift standing-up mechanism having an inclination steering mechanism is provided on the top portion of said gas cylinder.

[Detailed Description of the Invention]

[0001]

[Industrial Field of Utilization]

The present invention relates to a travelling device for climbing up and/or down stairs or travelling on the irregular ground designed to be used on a travelling carriage for a visual inspection device for use in buildings in a nuclear plant.

[0002]

[Prior Art]

Periodical visual inspections must be carried out in buildings in a nuclear plant. In these buildings there are many obstacles to travelling such as stairs and doorsills between rooms, and therefore it is not possible to carry out sufficient visual inspections by a device in which a visual inspection device is fitted on a mere travelling carriage. Consequently, there have been conventionally used devices that can climb up and/or down stairs or travel on the irregular ground.

[0003]

A prior art travelling device is shown in Fig. 1. As shown therein, it is a travelling device of a four-leg-walking type in which an inspection device main body 103 is mounted on the upper portion of a running carriage 102 having a pair of left and right driving wheels 101 and in which leg portions 104, 105 each comprising a pair of link mechanisms are provided at the front and rear of the running carriage 102.

[0004]

In order for this travelling device to climb up stairs 107 from a floor 106, the front and rear leg portions 104, 105 are bent and/or stretched with the left and right driving wheels being rotationally driven. Therefore, the inspection device 103

can move as shown by arrows in Fig. 4.

[0005]

[Problems that the Invention is to solve]

In the conventional travelling device described as above, the front and rear leg portions 104, 105 are bent and/or stretched so as to conform to the configuration of the stairs 10/, while the left and right driving wheels 101 are rotationally driven, whereby the inspection device main body 13 is moved. The leg portions 104, 105 and the driving wheels 101 are normally controlled by a control device. In this case, however, the travelling amount and range of the leg portions 104, 105 and the revolving speed of the driving wheels 101 become different depending on places where it travels, and this causes a problem that the mechanism and control of the device is made complicate. In addition, since this travelling device keeps its standing-up position by the leg portions 104, 105 and driving wheels 101 thereof, there are also problems that it easily falls down on the irregular ground and that once it falls down, it is difficult for the device to be restored to its standing position.

[0006]

The present invention was made to solve the above problems and an object thereof is to provide a travelling device that is prevented from falling down and which achieves simplification of the mechanisms and control thereof.

[0007]

[Means for solving the Problems]

In order to solve the above problems, the present invention provides a travelling device characterized in that an expandable gas cylinder is provided on a running carriage having a pair of driving wheels placed in parallel to each other and adapted to be driven independently in such a manner as to erect therefrom, and that a gyroscopic lift standing-up mechanism having an inclination steering mechanism is provided on the upper portion of the gas cylinder.

[0008]

[Function]

When trying to move the travelling device, the device main body is first caused to stand up by rotationally driving the device by means of the gyroscopic lift standing-up mechanism so as to generate lift, and then it is advanced by driving the driving wheels. The steering of the device during its advancement is achieved by virtue of the difference in the number of revolutions between the pair of driving wheels. In addition, in a case where the travelling device tries to ride on an obstacle while moving on the irregular ground such as stairs, the device main body is moved to the vicinity of the obstacle in a state in which the gas cylinder is being expanded, then it is inclined forward at that location by means of the inclination steering mechanism, and the gas cylinder is rapidly contracted so as to lift up the running carriage. Then, the travelling device is caused to travel in the air by virtue of a lift generated from the gyroscopic lift standing-up mechanism so as to ride on the obstacle, thereby achieving a soft landing on the obstacle. Once this is completed, the gas cylinder is restored again to its expanded state, and the device is advanced by driving the driving wheels.

[0009]**[Embodiment]**

Referring to the drawings, an embodiment of the present invention will now be described in detail.

[0010]

Fig. 1 shows a front view of a travelling device according to an embodiment of the present invention, Fig. 2 a plan view of the travelling device, and Fig. 3 an explanatory view explaining the function of the travelling device.

[0011]

As shown in Figs. 1 and 2, in the travelling device according to the embodiment of the present invention, a pair of left and right driving wheels 12, 13 adapted to be rotated independently are supported on a running carriage 11, and those driving wheels are designed to be rotationally driven,

respectively, by driving devices 14, 15 which each are exclusively used for the respective driving wheels. An expandable gas cylinder 16 is provided on this running carriage in such a manner as to erect therefrom. The gas cylinder 16 comprises a hollow cylinder case 17 located at the upper portion of thereof and a hollow piston rod 18 that is fitted in the hollow cylinder case 17 in such a manner as to freely move therein in a longitudinal direction (vertically), and is biased by means of a tensile coil spring 19 provided so as to extend between the two members in a direction in which the gas cylinder rapidly contracts. In addition, a mounting pedestal 20 is provided on the upper end of the cylinder case 17, while the running carriage 11 is mounted on the lower end of the piston rod 18.

[0012]

Mounted on the outer circumferential portion of the gas cylinder 16 is a gas pressure supplying/discharging system unit 21 having a control valve, a compressor, a chamber and so forth, and the unit is connected with the gas cylinder 16 via pipings 22, 23. Furthermore, fitted on the outer circumferential portion of the gas cylinder 16 is a power/control system unit 24, on which a visual inspection device 25 having a directional driving system is equipped in turn.

[0013]

A gyroscopic lift standing-up mechanism is provided on the mounting pedestal 20 of the gas cylinder 16 via an inclination steering mechanism. In the inclination steering mechanism, there are provided concentric annular frames 31, 32, 33 which are rotatably supported on, respectively, pairs of bearings 34, 35 each provided at opposite positions. In other words, the frame 31 is supported on the pair of bearings 34 in such a manner that it rotates about an X axis relative to the frame 32, and the frame 32 is made free to rotate about a Y axis which is perpendicular to the X axis relative to the frame 33 by means of the pair of bearings 35. The lower portion of this frame 33 is fixed onto the mounting pedestal 20 of the gas cylinder 16.

[0014]

The gyroscopic lift standing-up mechanism is provided inside the frame 31 described above. That is, a circular horizontal supporting table 36 is located at the center of the frame 31, and this supporting frame 36 is supported by four stabilizers 37 (with two of them being disclosed in Fig. 1) extending from respective four locations on the inner circumferential surface of the frame 31. A propeller 39 with a ring is mounted at a central portion of the supporting table 36 by means of a rotating shaft 38 in such a manner as to freely rotate about the shaft, and a spherical belt-like ring wing 41 is mounted on the outer circumferential portion of the propeller 39 via plurality of hourglass-shaped guide rollers 40 in such a manner as to freely rotate in a reverse direction. The rotating shaft 38 of the propeller 39 can be rotated by a small driving device 43 of high output.

[0015]

In addition, below the four stabilizers 37 four driving shafts 44 (with two being disclosed in Fig. 1) are rotatably supported between the respective stabilizers 37 and the frame 31, and flaps 45 are securely connected to the respective driving shafts 44, and a steering driving device 46 is connected to one end of each driving shaft 44.

[0016]

In order to move the travelling device, the driving device 43 is driven so as to rotate the propeller 39 via the rotating shaft 38. This causes a rotating force so produced to be transferred to the ring wing 41 via the hourglass-shaped guide rollers 40, whereby the ring wing 41 is rotated in a direction opposite to the rotating direction of the propeller 39, and a spinning force is cancelled, thereby producing a lift. Consequently, the device main body is caused to stand up, whereupon compressed gas is supplied to the gas cylinder 16 by means of the gas pressure supplying/discharging system unit 21 to thereby put the gas cylinder in a state in which it is expanded, while the driving wheels 12, 13 are rotatably driven

by driving the respective driving devices 14, 15, whereby the device main body is advanced on the flat ground by the travelling device. In this state, visual inspection is carried out by using the visual inspection device 25. In addition, steering operations can be performed by producing differences in the numbers of rotations of the driving wheels 12, 13 by so varying the numbers of rotations thereof.

[0017]

Furthermore, in a case where the travelling device climbs up stairs 51 while it travels through the irregular grounds such as stairs, as shown in Fig. 3 (a), the device main body is brought close to the obstacle while the gas cylinder 16 is being kept in a state in which it is expanded, and the selected ones of the four flaps 45 are rotated by the driving device 46, and a lift produced by the ring wing 41 is transferred into a propelling force to thereby incline the device main body forward. With this state being maintained, when compressed gas in the gas cylinder 16 is discharged therefrom, the gas cylinder 16 is rapidly contracted by means of the tensile coil spring 19, whereby the running carriage 11 is lifted up. This causes the device main body to float in the air momentarily, and, as shown in Fig. 3 (b), the device main body swings on the central portion of the ring wing 41 working as a fulcrum by virtue of the principle of pendulum so as to be put in a suspended state and softly lands on the stairs 51. After the landing, as shown in Fig. 3 (c), the gas cylinder 16 is put in the expanded state again so as to push up the device main body, and as described previously, the travelling device is advanced by rotationally driving the driving wheels 12, 13 by in turn driving the respective driving devices 14, 15.

[0018]

[Effectiveness of the Invention]

As is described in detail referring to the embodiment, in accordance with the travelling device of the present invention, since the expandable gas cylinder is provided on the running carriage having a pair of driving wheels located parallel to

each other and adapted to be driven independently in such a manner as to erect therefrom, and since the gyroscopic lift standing-up mechanism having the inclination steering mechanism is provided on the top portion of the gas cylinder, in a case where the travelling device needs to ride on an obstacle while travelling, the device main body is moved to the vicinity of the obstacle and caused to incline forward, and the gas cylinder is caused to be rapidly contracted so as to lift up the running carriage, whereby the travelling device can be moved in the air by virtue of a lift so produced, thus making it possible for the travelling device to easily ride on the obstacle while preventing itself from fall down. In addition, it is possible to simplify the mechanism and the control system of the travelling device, thereby making it possible to easily carry out inspecting operations on the irregular ground.

[Brief Description of the Drawings]

[Fig. 1]

This is a front view of a travelling device according to one embodiment of the present invention.

[Fig. 2]

This is a plan view of the travelling device.

[Fig. 3]

This is an explanatory view showing a function of the traveling device.

[Fig. 4]

This is a front view of a prior art travelling device.

[Description of Reference Numerals]

11 running carriage, 12, 13 driving wheels, 16 gas cylinder, 25 visual inspecting device, 31, 32, 33 frame, 39 propeller, 41 ring wing, 43 driving device, 45 flap.

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(71)出願人 000006208

三菱重工業株式会社

東京都千代田区丸の内二丁目5番1号

(72)発明者 永岡 悦雄

兵庫県神戸市兵庫区和田崎町一丁目1番1号

三菱重工業株式会社神戸造船所内

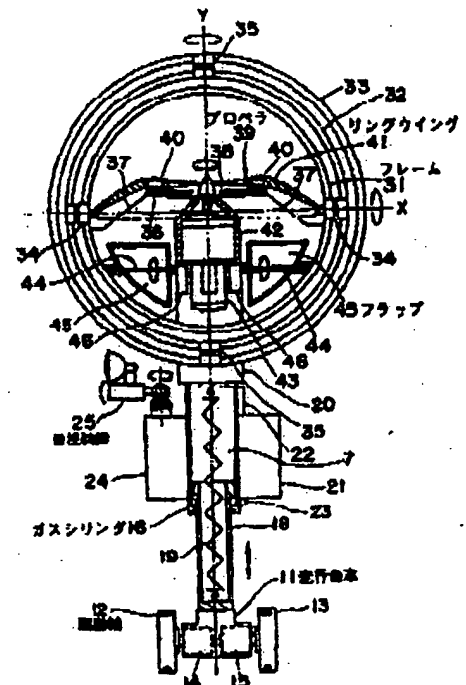
(74)代理人 弁理士 光石 俊郎 (外1名)

(54)【発明の名称】 移行装置

(57)【要約】

【目的】 装置の転倒を防止すると共に機構及び制御系の簡素化を図って容易に不整地などの点検作業を行うことができるようにする。

【構成】 移行装置において、並設され独立して駆動する左右一対の駆動輪12、13を有する走行台車11上に伸縮自在なガスシリング16を立設し、そのガスシリング16の上部に傾斜用換舵機構を有するジャイロスコープ状揚力起立機構を設け、移行中に障害物を乗り越える場合は、装置本体をこの障害物近傍まで移動してフラップ45によって前方を傾斜させ、ガスシリング16を急速に収縮して走行台車11を引上げることで揚力によって空中を移動させて障害物を乗り越える。



【特許請求の範囲】

【請求項1】 並設され独立して駆動する一対の駆動輪を有する走行台車上に伸縮自在なガスシリンダを立設し、該ガスシリンダの上部に傾斜用操舵機構を有するジャイロスコープ状揚力起立機構を設けたことを特徴とする移行装置。

【発明の詳細な説明】

【0001】

【産業上の利用分野】 本発明は原子カプラントの建物内における目視点検装置の移行台車に適用される階段や不整地などを移動する移行装置に関する。

【0002】

【従来の技術】 原子カプラントにおいてはその建物内を定期的に目視点検装置しなければならない。このような建物内には階段や部屋間の敷居などの移行障害が多く、単なる移行台車に目視点検装置を搭載しただけでは十分に点検を行うことができない。従って、階段や不整地などを移動できるものが従来から使用されている。

【0003】 図4に従来の移行装置を示す。同図に示すように、この移行装置は四脚歩行式の移行装置であって、左右一対の駆動輪101を有する走行台車102の上部には点検装置本体103が取付けられ、走行台車102の前後には一対のリンク機構からなる脚部104、105が取付けられている。

【0004】 而して、この移行装置が床面106から階段107を登って移動するには、前後の脚部104、105を屈伸させると共に左右の駆動輪101を回転駆動することで行う。従って、点検装置本体103は、同図に矢印で示すように、移動することができる。

【0005】

【発明が解決しようとする課題】 上述した従来の移行装置にあつては、階段107の形状に合わせて前後の脚部104、105を屈伸すると共に左右の駆動輪101を回転駆動して点検装置本体103を移動させるものである。脚部104、105及び駆動輪101の駆動は、通常、制御装置を用いて制御している。ところが、この場合、移動する部位によって脚部104、105の移動量や移動範囲、あるいは駆動輪101の回転速度などが異なり、その機構や制御自体が複雑になってしまうという問題があった。また、この移行装置は脚部104、105及び駆動輪101によって起立状態を保持しているため、不整地などで転倒しやすく、転倒した場合には姿勢の復帰が困難であるという問題があった。

【0006】 本発明はこのような問題点を解決するものであつて、転倒を防止すると共に機構及び制御の簡素化を図った移行装置を提供することを目的とする。

【0007】

【課題を解決するための手段】 上述の目的を達成するための本発明の移行装置は、並設され独立して駆動する一対の駆動輪を有する走行台車上に伸縮自在なガスシリン

ダを立設し、該ガスシリンダの上部に傾斜用操舵機構を有するジャイロスコープ状揚力起立機構を設けたことを特徴とするものである。

【0008】

【作用】 移行装置を移動するには、ジャイロスコープ状揚力起立機構によって旋回駆動して揚力を発生させて装置本体を起立させ、駆動輪を駆動して前進させる。このとき、一対の駆動輪の回転数の差によってスアアリング操作を行う。そして、階段などの不整地の移行中に障害物乗り越える場合は、ガスシリンダの伸長状態で装置本体をこの障害物近傍まで移動して傾斜用操舵機構によって装置本体を前方に傾斜させ、ガスシリンダを急速に収縮して走行台車を引上げる。すると、ジャイロスコープ状揚力起立機構の揚力によって空中を移動して障害物上に軟着地する。そして、再び、ガスシリンダの伸長状態とし、駆動輪を駆動することで前進する。

【0009】

【実施例】 以下、図面に基ついて本発明の実施例を詳細に説明する。

【0010】 図1に本発明の一実施例に係る移行装置の正面、図2に移行装置の平面、図3に作動説明を示す。

【0011】 図1及び図2に示すように、本実施例の移行装置において、走行台車11には独立して回転する左右一対の駆動輪12、13が支持されており、それぞれ専用の駆動装置14、15によって回転駆動することができるようになっている。この走行台車11には伸縮自在なガスシリンダ16が立設されている。ガスシリンダ16は上部に位置する中空のシリンダケース17とこのシリンダケース17に長手（上下）方向移動自在に嵌合する中空のピストンロッド18とからなり、両者の間に張設された引張コイルばね19によって急速収縮する方向に付勢されている。そして、シリンダケース17の上端部には取付台座20が取付けられる一方、ピストンロッド18の下端部は走行台車11に取付けられている。

【0012】 また、ガスシリンダ16の外周部には制御弁やコンプレッサ、チャンバ等を有するガス圧給排系ユニット21が装着され、ガスシリンダ16と配管22、23によって連結されている。更に、ガスシリンダ16の外周部には電線・制御系ユニット24が装着され、この電源・制御系ユニット24には指向駆動系付目視装置25が搭載されている。

【0013】 ガスシリンダ16の取付台座20には傾斜用操舵機構を介してジャイロスコープ状揚力起立機構が設けられている。傾斜用操舵機構において、同心円の円環状のフレーム31、32、33がそれぞれ対向して設けられた一対の軸受34、35によって回転自在に支承されている。即ち、フレーム31は一対の軸受34によってフレーム32に対してX軸をもって回転自在であり、フレーム32は一対の軸受35によってフレーム33に対してX軸と直行するY軸をもって回転自在であ

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る。そして、このフレーム33の下部はガスシリンダ16の取付台座20に固定されている。

【0014】ジャイロ스코ープ状揚力起立機構は上述したフレーム31内に設けられている。即ち、フレーム31内にはその中央に円板状の水平をなす支持台36が位置し、この支持台36はフレーム31の内周面の四方から延設された4つのスタビライザ37（図1では2つ開示）によって支持されている。支持台36の中央部には回転軸38によってリング付プロペラ39が回転自在に取付けられ、このプロペラ39の外周部には複数の鼓状のガイドローラ40を介して球帯状のリングウイング41が反転回転自在に装着されている。プロペラ39の回転軸38はハウジング42内に設けられた小型高出力の駆動装置43によって回転駆動することができる。

【0015】また、4つのスタビライザ37の下方には各スタビライザ37とフレーム31との間に四本の駆動軸44（図1では2つ開示）が回転自在に支承され、この駆動軸44にそれぞれフラップ45が固結されると共に、各駆動軸44の一端には換舵用駆動装置46が連結されている。

【0016】而して、移行装置を移動するには、駆動装置43を駆動して回転軸38を介してプロペラ39を回転させる。すると、この回転力は複数の鼓状のガイドローラ40を介してリングウイング41に伝達され、このリングウイング41はプロペラ39とは逆方向に旋回し、スピニングがキャンセルされて揚力が発生する。従って、装置本体が起立し、このときにガス圧給排系ユニット21によってガスシリンダ16に圧縮ガスを供給して伸長させた状態とし、各駆動装置14、15を駆動することによって駆動輪12、13を回転駆動し、平地上を走行台車11が装置本体を前進させる。この状態で目視装置25によって目視点検が行われる。なお、一对の駆動輪12、13の回転数を変化させることで、その差によってステアリング操作を行うことができる。

【0017】また、移行装置が階段などの不整地の移行中に階段51を乗り越える場合には、図3(a)に示すように、ガスシリンダ16の伸長状態で装置本体をこの障害物近傍まで移動し、4つのフラップ45の中から選択して駆動装置46によって回動し、リングウイング41によって発生した揚力を推進力に変え、装置本体を前

方に傾斜させる。そして、この状態でガスシリンダ16の圧縮ガスを排出することで引張コイルばね19によって急速に収縮し、走行台車11を引上げる。すると、装置本体が揚力によって瞬間的に空中に浮き、図3(b)に示すように、振子の原理で装置本体がリングウイング41の中心部を支点として揺動して垂下状態となりながら階段51上に軟着地する。着地後は、図3(c)に示すように、再び、ガスシリンダ16を伸長状態として装置本体を押し上げ、前述と同様に、各駆動装置14、15を駆動することによって駆動輪12、13を回転駆動して前進させる。

【0018】

【発明の効果】以上、実施例を挙げて詳細に説明したように本発明の移行装置によれば、並設され独立して駆動する一对の駆動輪を有する走行台車上に伸縮自在なガスシリンダを立設し、そのガスシリンダの上部に傾斜用換舵機構を有するジャイロ스코ープ状揚力起立機構を設けたので、移行中に障害物を乗り越える場合は、装置本体をこの障害物近傍まで移動して前方を傾斜させ、ガスシリンダを急速に収縮して走行台車を引上げることで揚力によって空中を移動することで簡単に障害物を乗り越えることができ、装置の転倒を防止することができる。また、機構及び制御系の簡素化を図ることができ、容易に不整地などの点検作業を行うことができる。

【図面の簡単な説明】

【図1】本発明の一実施例に係る移行装置の正面図である。

【図2】移行装置の平面図である。

【図3】移行装置の作動説明図である。

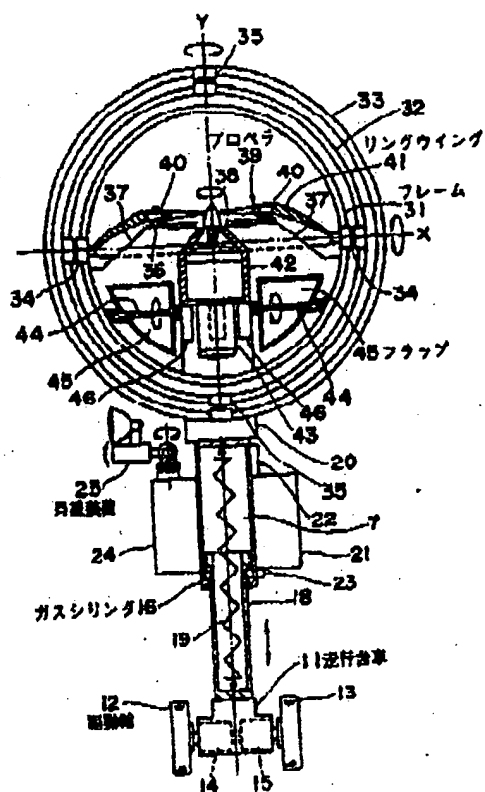
【図4】従来の移行装置の正面図である。

【符号の説明】

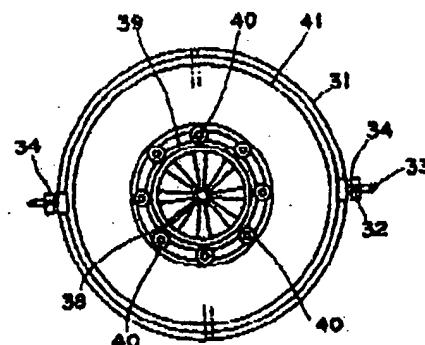
- 11 走行台車
- 12, 13 駆動輪
- 16 ガスシリンダ
- 25 目視装置
- 31, 32, 33 フレーム
- 39 プロペラ
- 41 リングウイング
- 43 駆動装置
- 45 フラップ

(4)

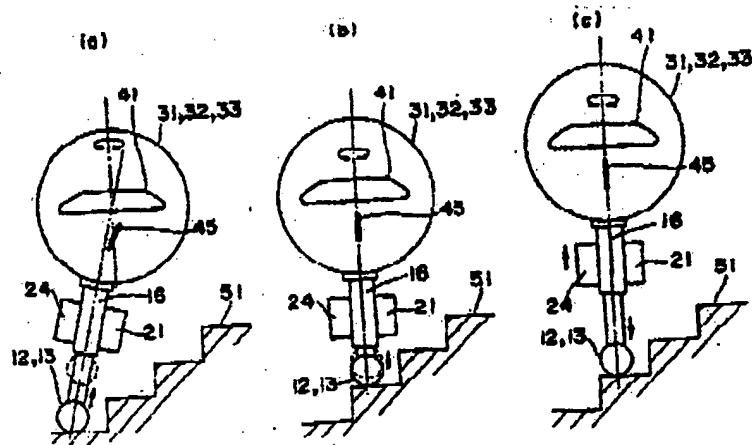
【図1】



【図2】



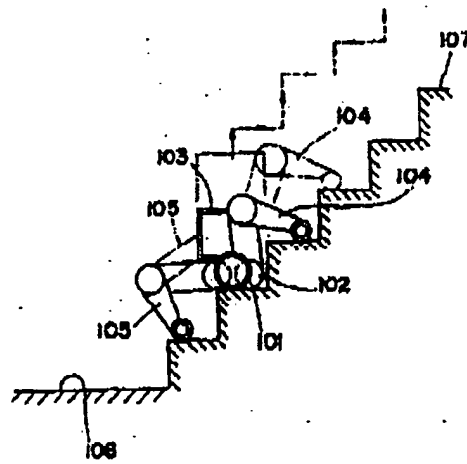
【図3】



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(5)

【図4】



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